



Test Report

Industry Canada RSS-Gen Issue 3/RSS-210 Issue 8 FCC Part15 Subpart C

Product Name : Surface Radio
Model No. : DX2E
FCC ID : BRWDSTX1
IC : 6157A-STX1

Applicant : Horizon Hobby,Inc.

Address : 4105 Fieldstone Rd.Champaign, IL 61822

Date of Receipt : 28/08/2012
Test Date : 28/08/2012~21/11/2012
Issued Date : 23/11/2012
Report No. : 128S067R-RF-US-P05V01
Report Version : V2.1

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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Test Report Certification

Issued Date : 23/11/2012

Report No. : 128S067R-RF-US-P05V01



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Applicant : Horizon Hobby, Inc.
Address : 4105 Fieldstone Rd.Champaign, IL 61822
Manufacturer : Horizon Hobby, Inc.
Address : 4105 Fieldstone Rd.Champaign, IL 61822
Model No. : DX2E
FCC ID : BRWDSTX1
IC : 6157A-STX1
EUT Voltage : 6V
Brand Name : Spektrum
Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2012
ANSI C63.4: 2009; ANSI C63.10: 2009
Industry Canada RSS-Gen Issue 3/RSS-210 Issue 8
Test Result : Complied
Performed Location : Suzhou EMC Laboratory
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FCC Registration Number: 800392; IC Lab Code: 4075B

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Laboratory Information

We, **Quietek Corporation**, are an independent EMC and safety consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted(audited or listed) by the following related bodies in compliance with ISO 17025, EN 45001 and specified testing scope:

Taiwan R.O.C.	:	BSMI, NCC, TAF
Germany	:	TUV Rheinland
Norway	:	Nemko, DNV
USA	:	FCC, NVLAP
Japan	:	VCCI
China	:	CNAS

The related certificate for our laboratories about the test site and management system can be downloaded from Quietek Corporation's Web Site :<http://www.quietek.com/tw/ctg/cts/accreditations.htm>

The address and introduction of Quietek Corporation's laboratories can be founded in our Web site :
<http://www.quietek.com/>

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1. General Information

1.1. EUT Description

Product Name	Surface Radio
Brand Name	Specktrum
Model No.	DX2E
EUT Voltage	6V
Frequency Range	2418~2460MHz
Channel Number	43
Technology of Modulation	DSSS
Type of Modulation	GFSK
Channel Control	Auto
Antenna Delivery	1*Tx + 1*Rx
Antenna Type	Dipole Antenna
Peak Antenna Gain	2dBi



Working Frequency of Each Channel:

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2418 MHz	02	2419 MHz	03	2420 MHz	04	2421 MHz
05	2422 MHz	06	2423 MHz	07	2424 MHz	08	2425 MHz
09	2426 MHz	10	2427 MHz	11	2428 MHz	12	2429 MHz
13	2430 MHz	14	2431 MHz	15	2432 MHz	16	2433 MHz
17	2434 MHz	18	2435 MHz	19	2436 MHz	20	2437 MHz
21	2438 MHz	22	2439 MHz	23	2440 MHz	24	2441 MHz
25	2442 MHz	26	2443 MHz	27	2444 MHz	28	2445 MHz
29	2446 MHz	30	2447 MHz	31	2448 MHz	32	2449 MHz
33	2450 MHz	34	2451 MHz	35	2452 MHz	36	2453 MHz
37	2454 MHz	38	2455 MHz	39	2456 MHz	40	2457 MHz
41	2458 MHz	42	2459 MHz	43	2460 MHz	N/A	N/A



1.2. Mode of Operation

Quietek has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmit

Note:

1. This device is a composite device in accordance with Part 15 Subpart B regulations. The function for the receiver was measured and made a test report that the report number is 128S067R-RF-US-P01V02.

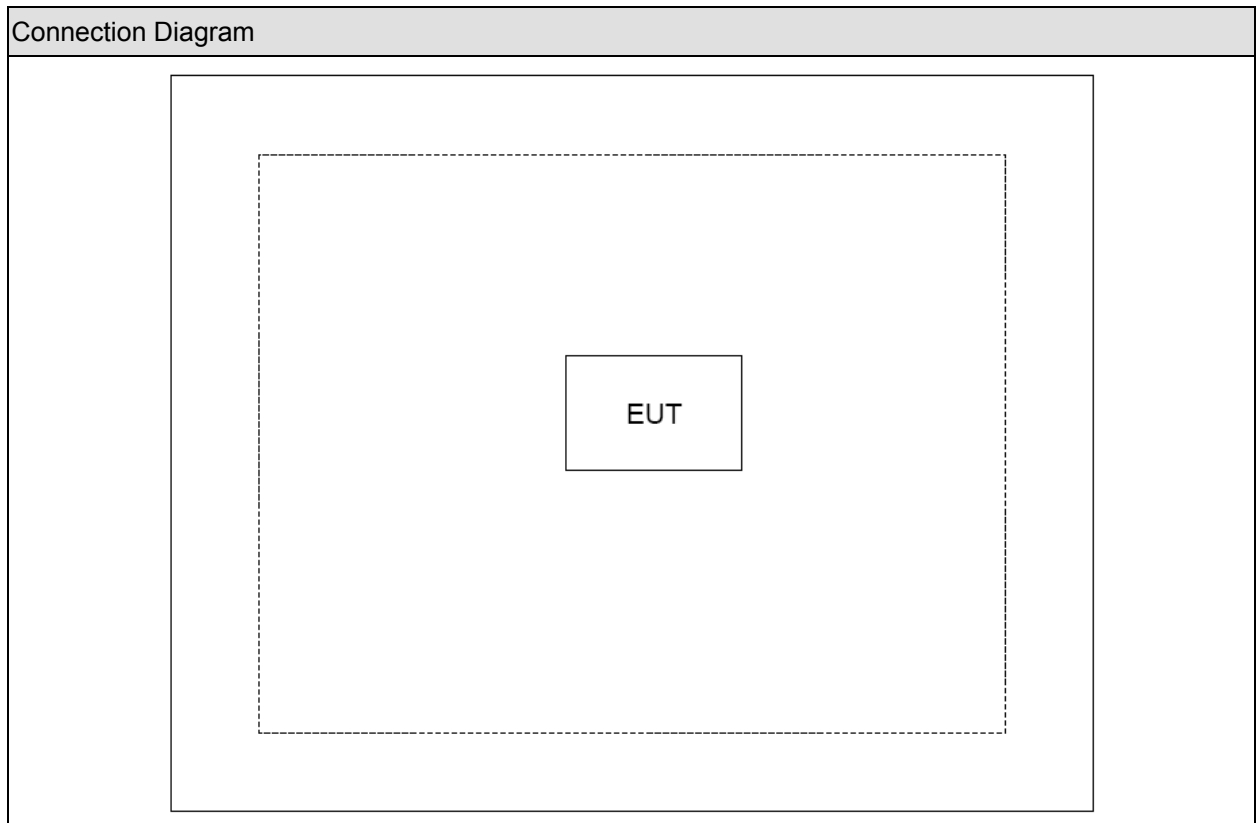


1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product		Manufacturer	Model No.	Serial No.	Power Cord
1	N/A	N/A	N/A	N/A	N/A

1.4. Configuration of Tested System





1.5. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of equipment.
3	Setup the test channel and the test mode to start the continue transmit.



2. Technical Test

2.1. Summary of Test Result

- ☒ No deviations from the test standards
- ☐ Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2011 Section 15.207	N/A	N/A
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2011 Section 15.209	Yes	No
RF Antenna Conducted Spurious	FCC CFR Title 47 Part 15 Subpart C: 2011 Section 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2011 15.247(d)	Yes	No
Operation Frequency Range of 20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2011 15.215(c)	Yes	No
Occupied Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2011 Section 15.247(a)(2)	Yes	No
Power Output	FCC CFR Title 47 Part 15 Subpart C: 2011 Section 15.247(b)(3)	Yes	No
Power Spectral Density	FCC CFR Title 47 Part 15 Subpart C: 2011 Section 15.247(e)	Yes	No



Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS-Gen Issue 3 December 2010 Section 7.2.2	N/A	N/A
Radiated Emission	RSS-210 Issue 8 December 2010 Section 2.7 Table 2 and Table 3	Yes	No
RF Antenna Conducted Spurious	RSS-210 Issue 8 December 2010 Section A8.5	Yes	No
Radiated Emission Band Edge	RSS-210 Issue 8 December 2010 Section A8.5	Yes	No
Occupied Bandwidth	RSS-Gen Issue 3 December 2010 Section 4.6.1 and 4.6.2 RSS-210 Issue 8 December 2010 Section A8.2(1)	Yes	No
Power Output	RSS-210 Issue 8 December 2010 Section A8.4(4)	Yes	No
Power Spectral Density	RSS-210 Issue 8 December 2010 Section A8.2(2)	Yes	No



2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

3. Conducted Emission

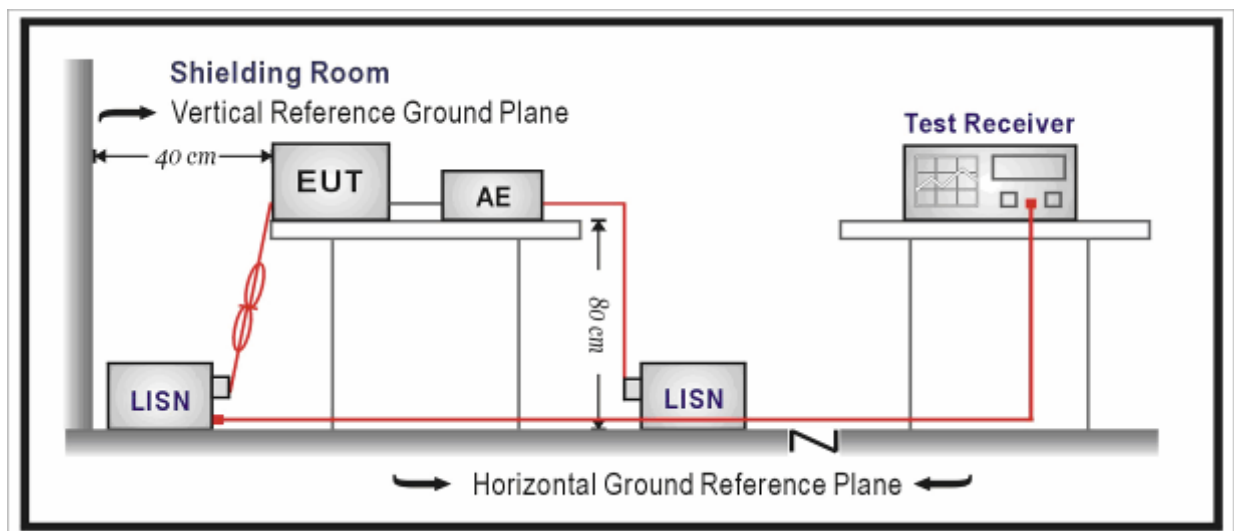
3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
EMI Test Receiver	R&S	ESCI	100726	2013.04.18
Two-Line V-Network	R&S	ENV216	100043	2013.04.18
Two-Line V-Network	R&S	ENV216	100044	2013.09.17
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2013.03.02
50ohm Termination	SHX	TF2	07081401	2013.09.17
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2013.01.10

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

3.2. Test Setup



3.3. Limit

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 – 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

3.4. Test Procedure

The EUT was setup according to ANSI C63.4, 2009 and tested according to ANSI C63.10: 2009 for compliance to FCC 47CFR 15.247 requirements. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs) Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length. Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.

3.5. Uncertainty

The measurement uncertainty is defined as ± 2.02 dB



3.6. Test Result

The EUT rely on battery-powered, so this test item needn't perform.



4. Radiated Emission

4.1. Test Equipment

Radiated Emission / AC-2

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
EMI Test Receiver	R&S	ESCI	100573	2013.04.18
Loop Antenna	R&S	HFH2-Z2	833799/003	2013.11.17
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2013.10.15
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2013.03.02
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2013.05.07

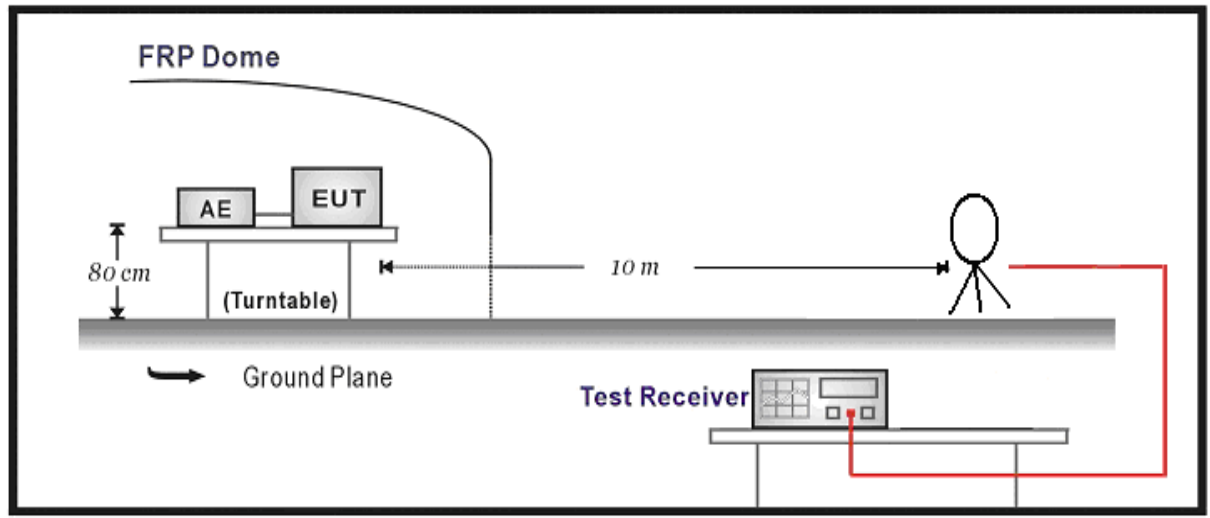
Radiated Emission / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2013.04.18
Preamplifier	Miteq	NSP1800-25	1364185	2013.05.04
Preamplifier	Quietek	AP-040G	CHM-0906001	2013.05.04
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2013.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2014.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2013.11.24
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2013.03.02
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2013.03.02
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2013.03.02
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2013.01.10

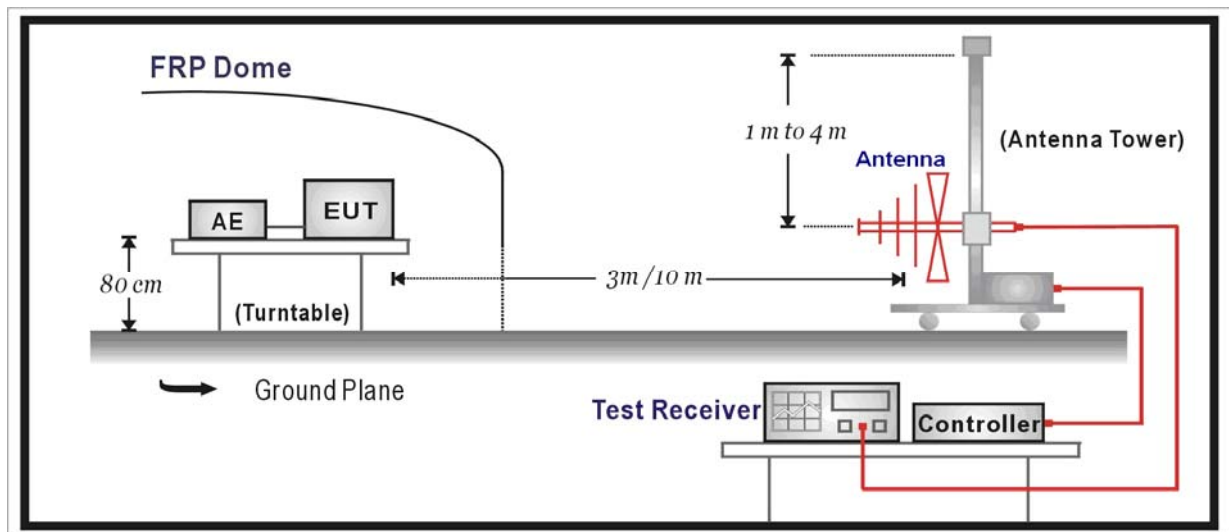
Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

4.2. Test Setup

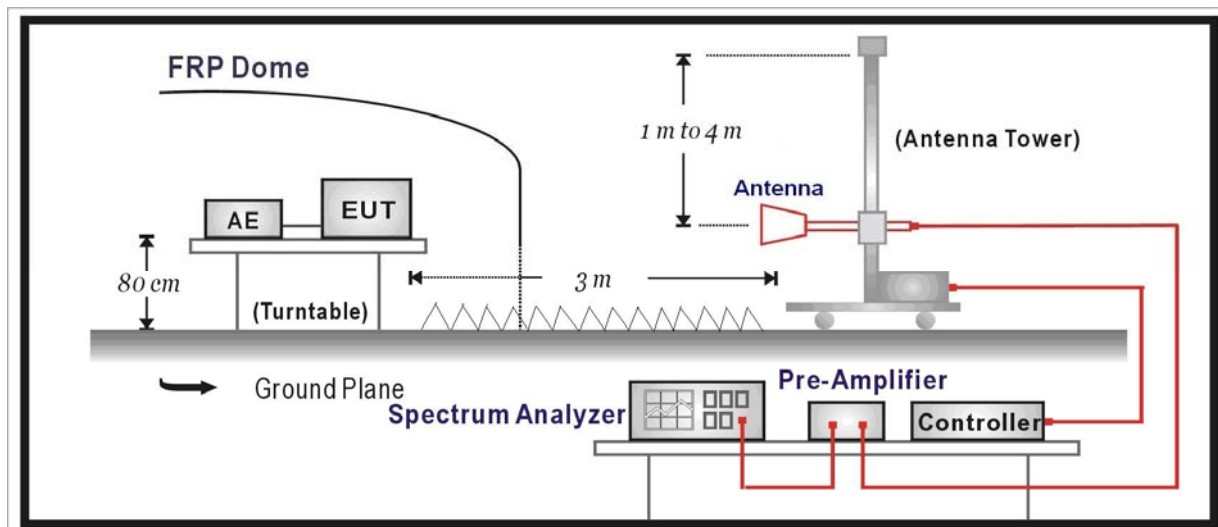
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



4.3. Limit

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

4.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2009 and tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This

is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 60 degrees for H-plane and 90 degrees for E-plane.

4.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB
below 1G is defined as ± 3.8 dB



4.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
2418	V	2418.2	72.5	36.5	109.0	Fundamental	/	PK
	V	288.0	21.0	20.1	41.1	46	-4.9	QP
	H	312.0	24.5	20.9	45.4	46	-0.6	QP
	V	3227.0	57.7	-9.7	48.0	54(note3)	-6.0	PK
	H	4833.5	71.4	-7.6	63.8	74	-10.2	PK
	H	4835.8	37.4	-7.7	29.7	54	-24.3	AV
	H	7256.0	67.8	-3.0	64.8	74	-9.2	PK
	H	7256.0	34.2	-3.0	31.2	54	-22.8	AV
	H	24000.0	59.1	-8.9	50.2	54(note3)	-3.8	PK
2440	V	2444.1	76	32.7	108.7	Fundamental	/	PK
	H	288.0	20.5	20.1	40.6	46	-5.4	QP
	H	312.0	24.9	20.9	45.8	46	-0.2	QP
	V	3252.5	55.4	-9.7	45.7	54(note3)	-8.3	PK
	H	4876.0	70.8	-7.6	63.2	74	-10.8	PK
	H	4879.8	37.0	-7.6	29.4	54	-24.6	AV
	H	7324.0	65.8	-2.9	62.9	74	-11.1	PK
	H	7320.0	34.0	-2.9	31.1	54	-22.9	AV
	H	24000.0	59.1	-8.9	50.2	54(note3)	-3.8	PK
2460	V	2459.8	80.9	30.9	111.8	Fundamental	/	PK
	H	288.0	20.6	20.1	40.7	46	-5.3	QP
	H	312.0	24.0	20.9	44.9	46	-1.1	QP
	V	3278.0	56.1	-9.6	46.5	54(note3)	-7.5	PK
	H	4918.5	71.9	-7.6	64.3	74	-9.7	PK
	H	4920.0	37.4	-7.6	29.8	54	-24.2	AV
	H	7383.5	59.3	-2.7	56.6	74	-17.4	PK
	H	7380.0	33.8	-2.7	31.1	54	-22.9	AV
	H	24000.0	59.1	-8.9	50.2	54(note3)	-3.8	PK



Note: 1. Measure Level = Reading Level + Factor.

2. The test trace is same as the ambient noise (the test frequency range: 9kHz~30MHz, 18GHz~25GHz), therefore no data appear in the report.

3. This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

5. RF Antenna Conducted Spurious

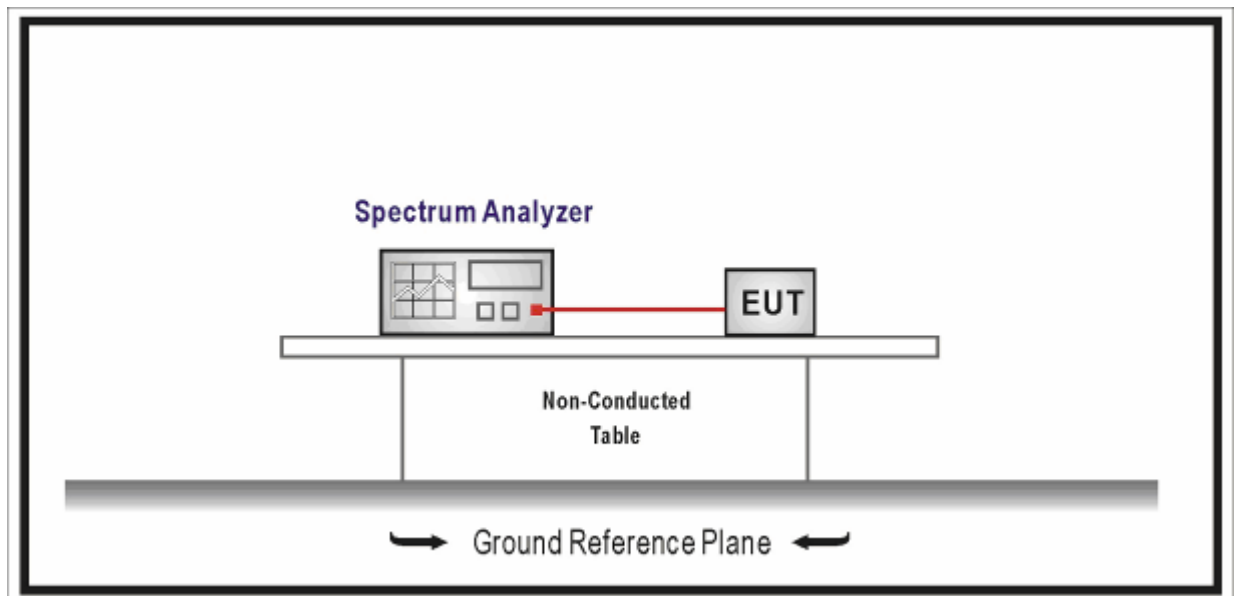
5.1. Test Equipment

RF Antenna Conducted Spurious / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2013.04.18
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2013.05.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

5.2. Test Setup



5.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.



5.4. Test Procedure

The EUT was tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Set VBW > RBW, scan up through 10th harmonic.

5.5. Uncertainty

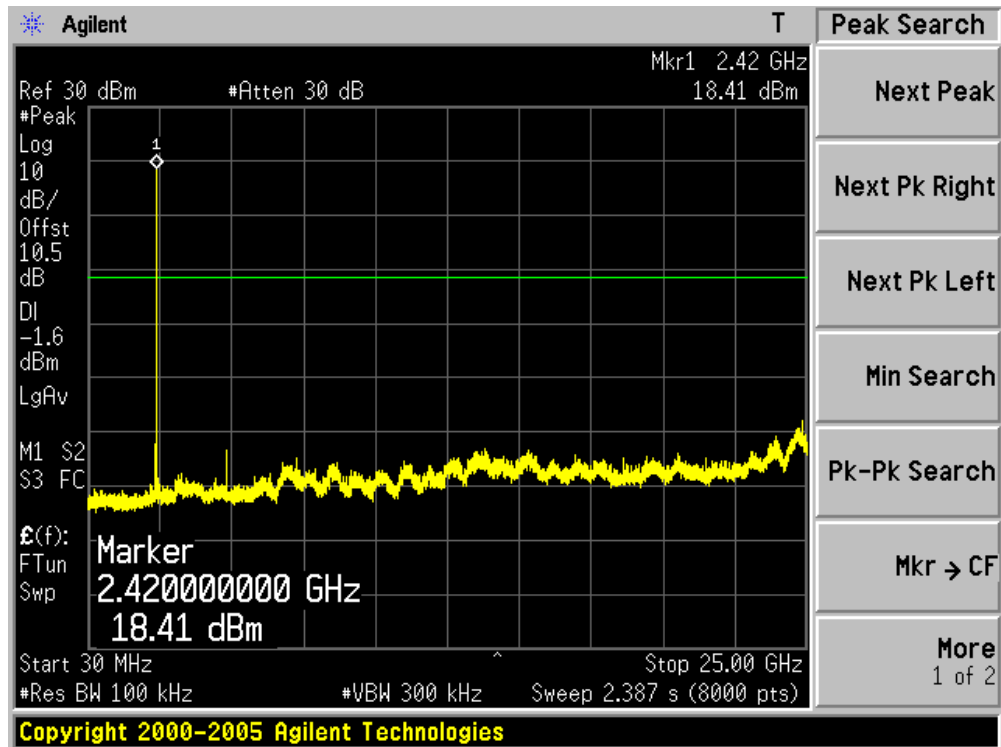
The measurement uncertainty is defined as ± 1.27 dB



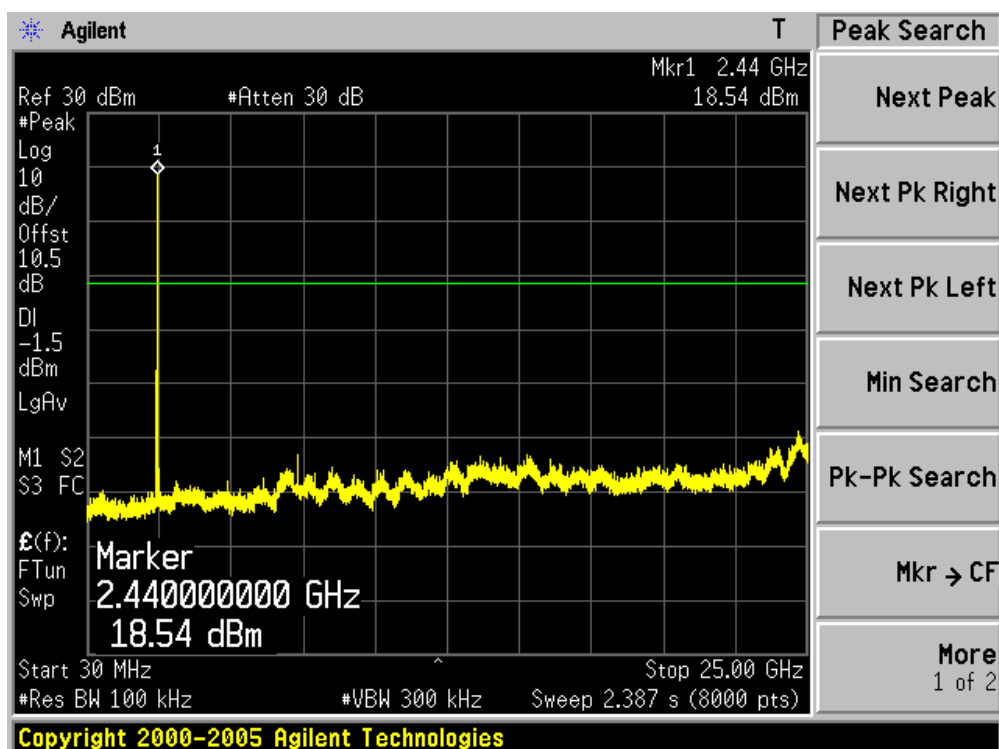
5.6. Test Result

Product	:	Surface Radio
Test Item	:	RF Antenna Conducted Spurious
Test Site	:	TR-8
Test Mode	:	Mode 1

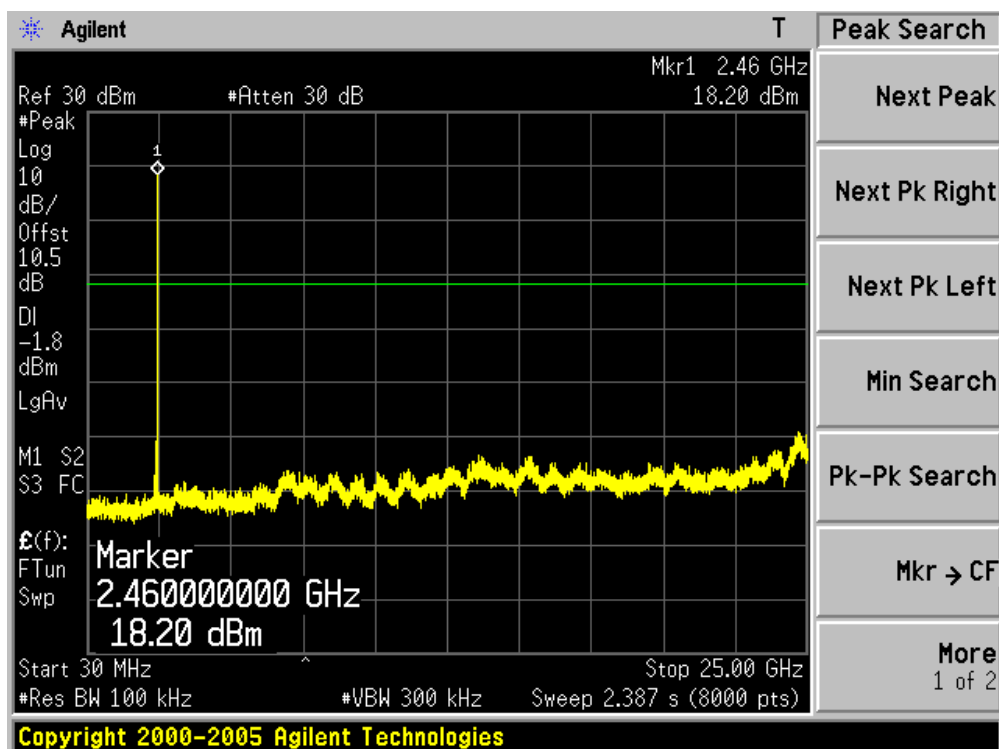
Channel 01 (2418MHz)



Channel 23 (2440MHz)



Channel 43 (2460MHz)





6. Radiated Emission Band Edge

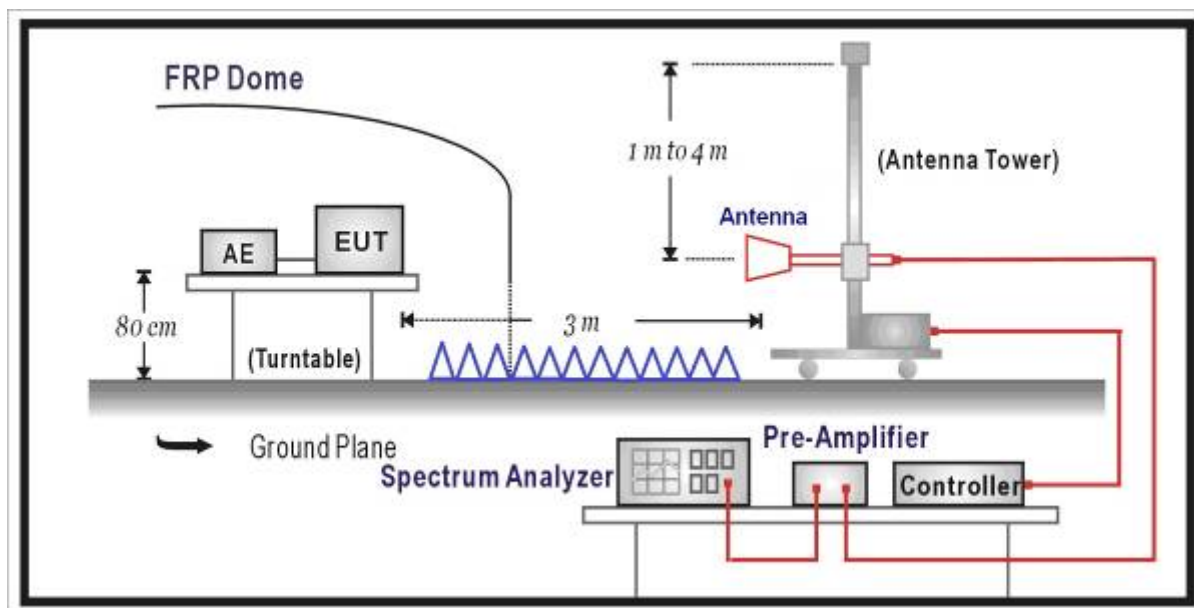
6.1. Test Equipment

☒ Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cali. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2013.04.18
EMI Test Receiver	R&S	ESCI	100573	2013.04.18
Preamplifier	Miteq	NSP1800-25	1364185	2013.05.04
Preamplifier	Quietek	AP-040G	CHM-0906001	2013.05.04
Bilog Type Antenna	Schaffner	CBL6112B	2932	2013.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2014.06.08
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2013.03.02
Temperature/Humidity Meter	zhicheng	ZC1-2	AC5-TH	2013.01.10

Note 1: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

6.2. Test Setup



6.3. Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

6.4. Test Procedure

The EUT was setup according to ANSI C63.4: 2009 and tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2009 on radiated measurement.

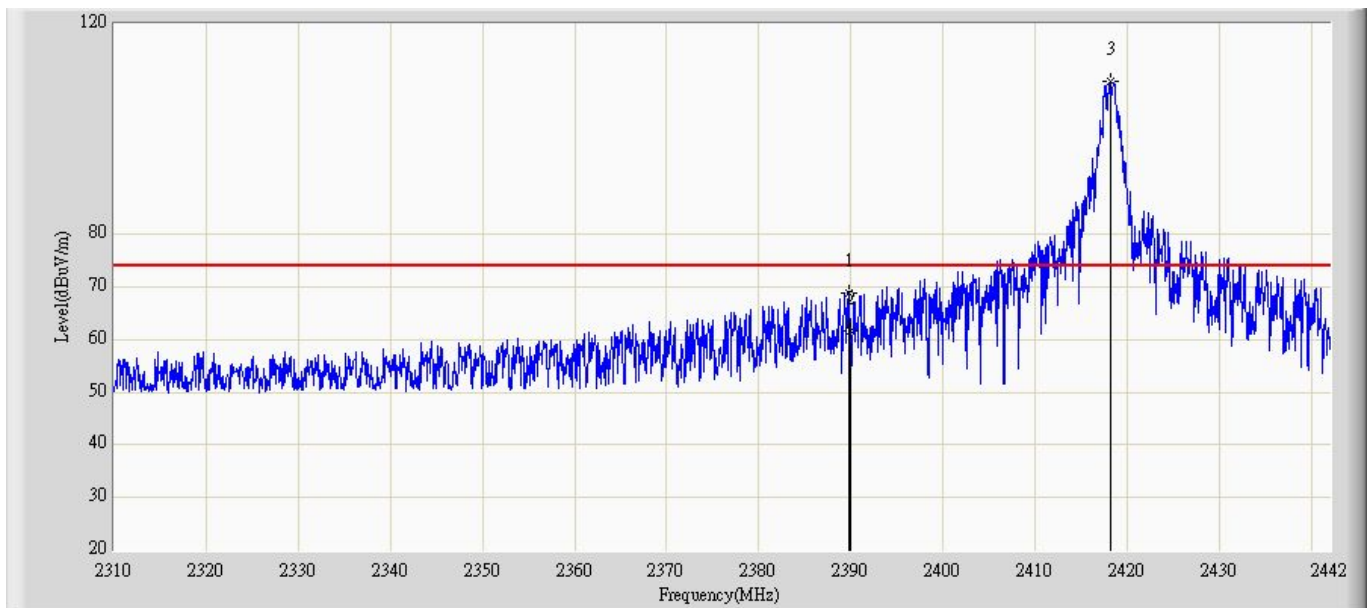
6.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB



6.6. Test Result

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 09:45
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Horizontal
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2418MHz	

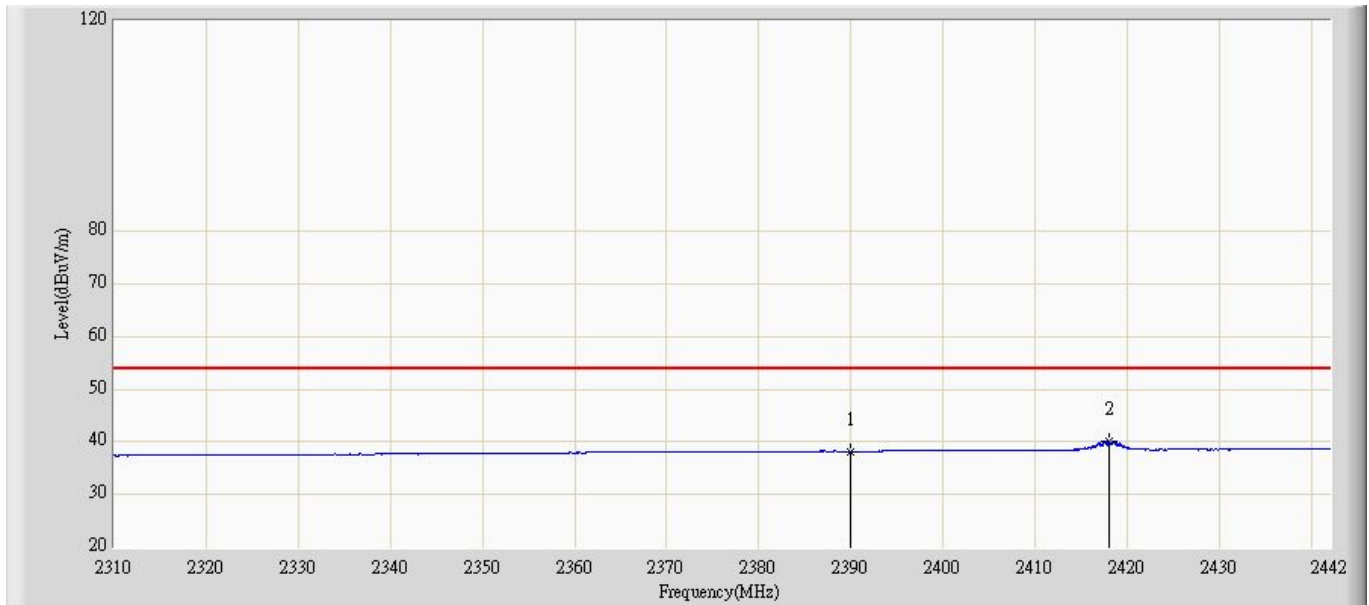


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			2389.728	68.720	32.421	-5.280	74.000	36.299	PK
2			2390.000	61.787	25.486	-12.213	74.000	36.302	PK
3		*	2418.174	109.031	72.494	N/A	N/A	36.536	PK



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:03
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Horizontal
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2418MHz	

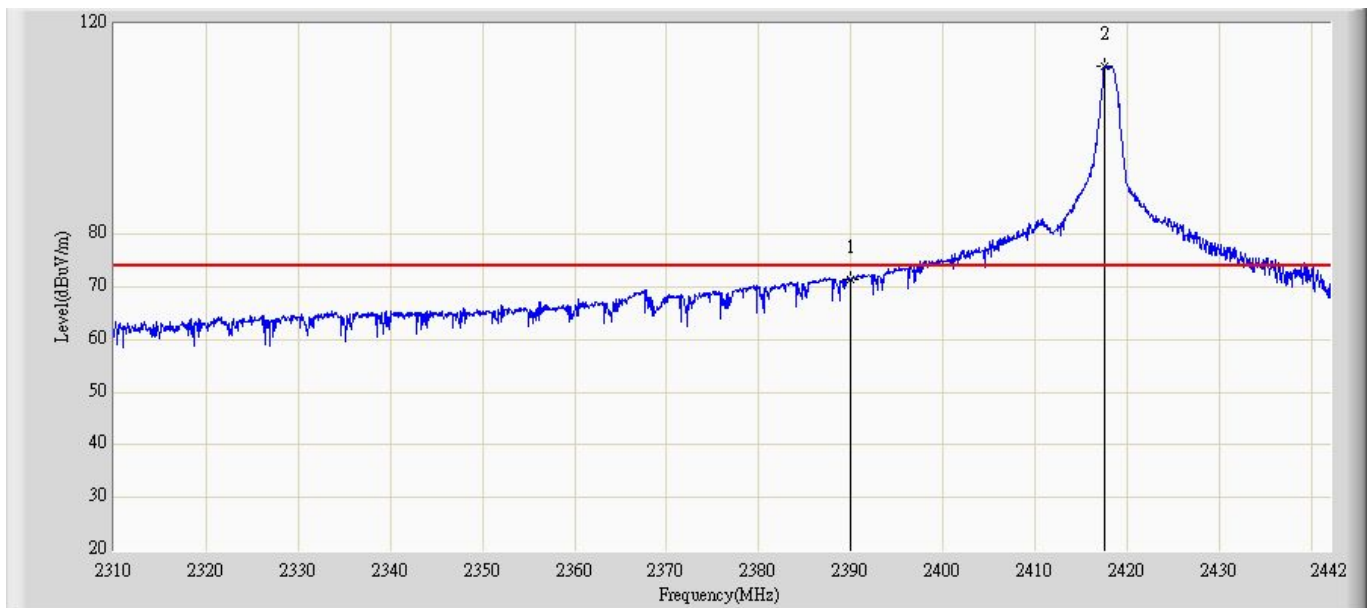


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			2390.000	38.186	1.885	-15.814	54.000	36.302	AV
2		*	2418.108	40.216	3.680	N/A	N/A	36.536	AV



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:04
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Vertical
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2418MHz	

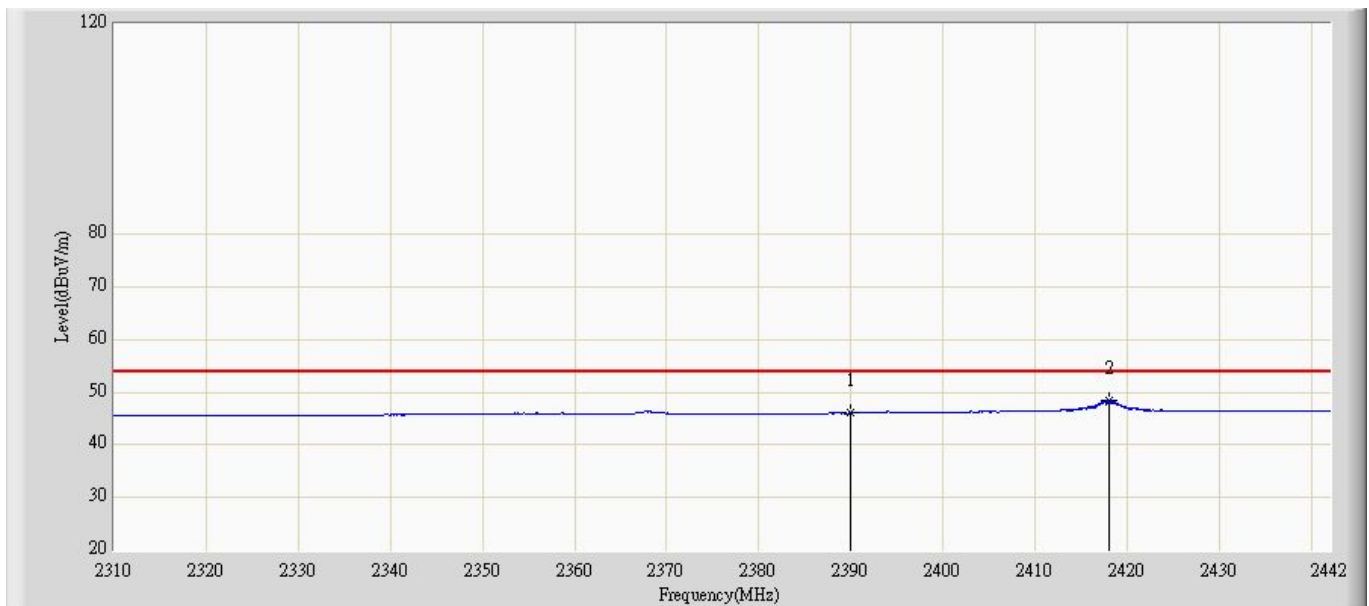


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			2390.000	71.504	35.863	-2.496	74.000	35.642	PK
2		*	2417.580	111.844	76.083	N/A	N/A	35.762	PK



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:10
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Vertical
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2418MHz	

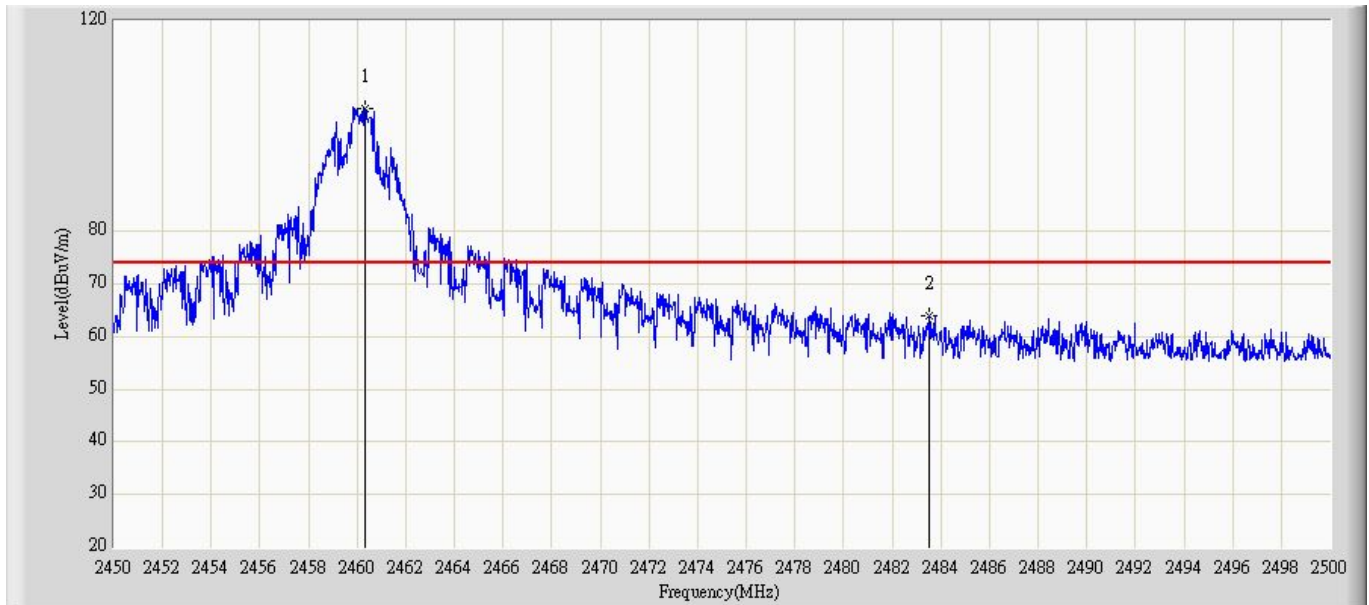


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1			2390.000	46.010	10.369	-7.990	54.000	35.642	AV
2		*	2417.976	48.525	12.762	N/A	N/A	35.763	AV



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:12
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Horizontal
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2460MHz	

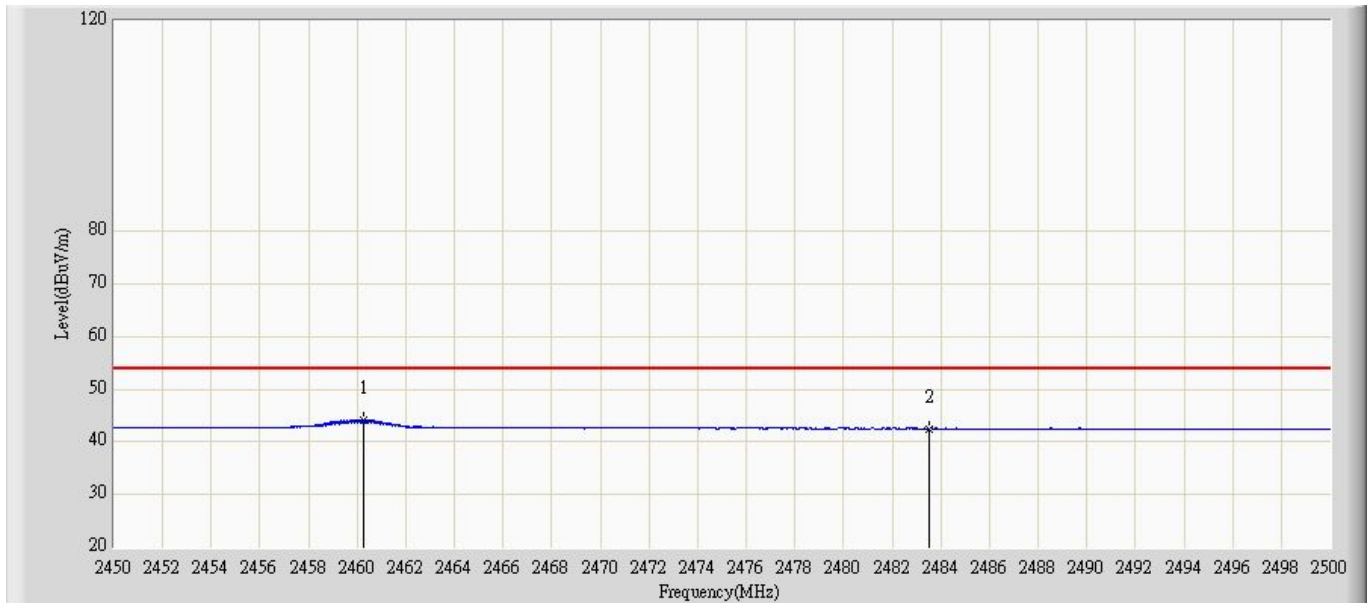


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2460.300	103.421	72.494	N/A	N/A	30.927	PK
2			2483.500	64.052	33.066	-9.948	74.000	30.985	PK



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:18
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Horizontal
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2460MHz	

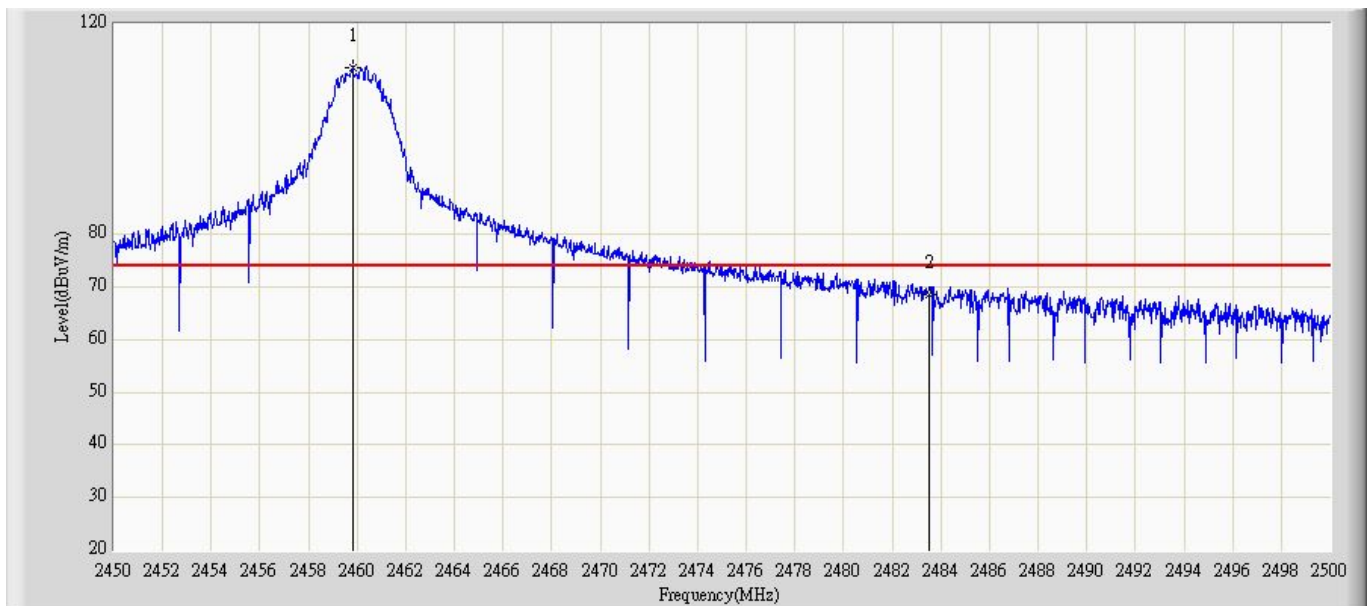


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2460.250	44.142	13.215	N/A	N/A	30.927	AV
2			2483.500	42.549	11.564	-11.451	54.000	30.985	AV



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:19
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Vertical
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2460MHz	

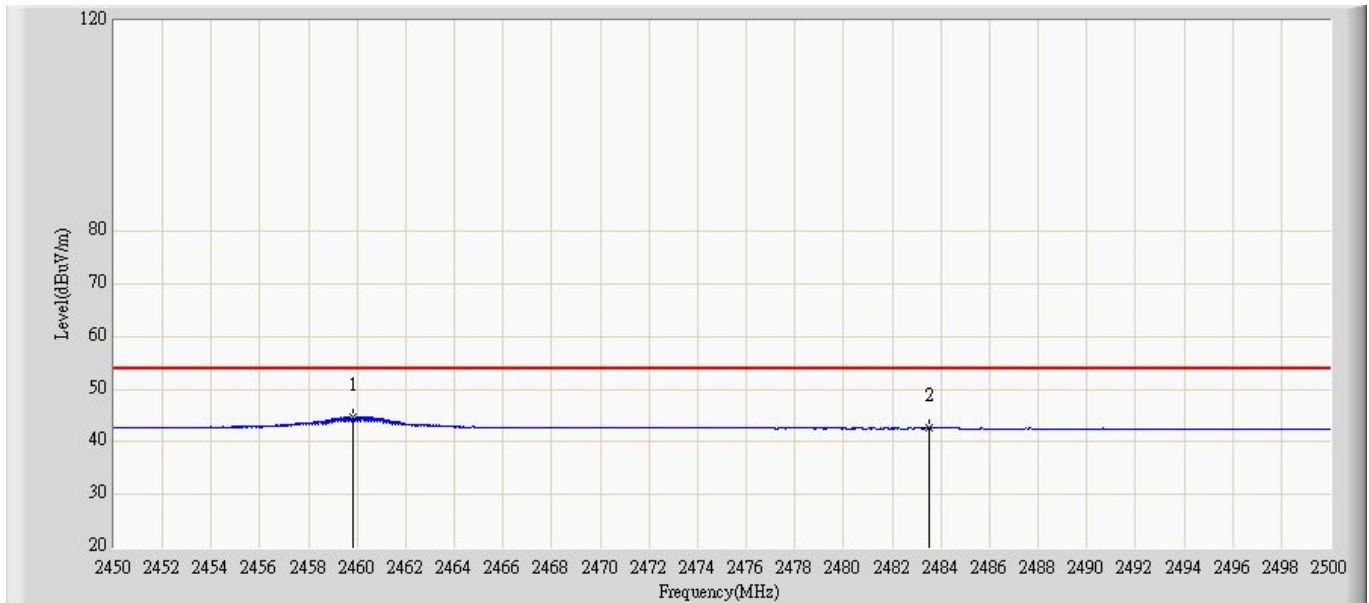


No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2459.800	111.801	80.876	N/A	N/A	30.925	PK
2			2483.500	68.558	37.572	-5.442	74.000	30.985	PK



Report No: 128S067R-RF-US-P05V01

Engineer: Milo	
Site: AC5	Time: 2012/11/16 - 10:21
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: BBHA 9120D_499(1-18GHz)	Polarity: Vertical
EUT: DX2E	Power: DC 6V
Note: Mode1:Transmit at channel 2460MHz	



No	Flag	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor	Type
1		*	2459.850	44.737	13.811	N/A	N/A	30.925	AV
2			2483.500	42.608	11.622	-11.392	54.000	30.985	AV

7. Operation Frequency Range of 20dB Bandwidth

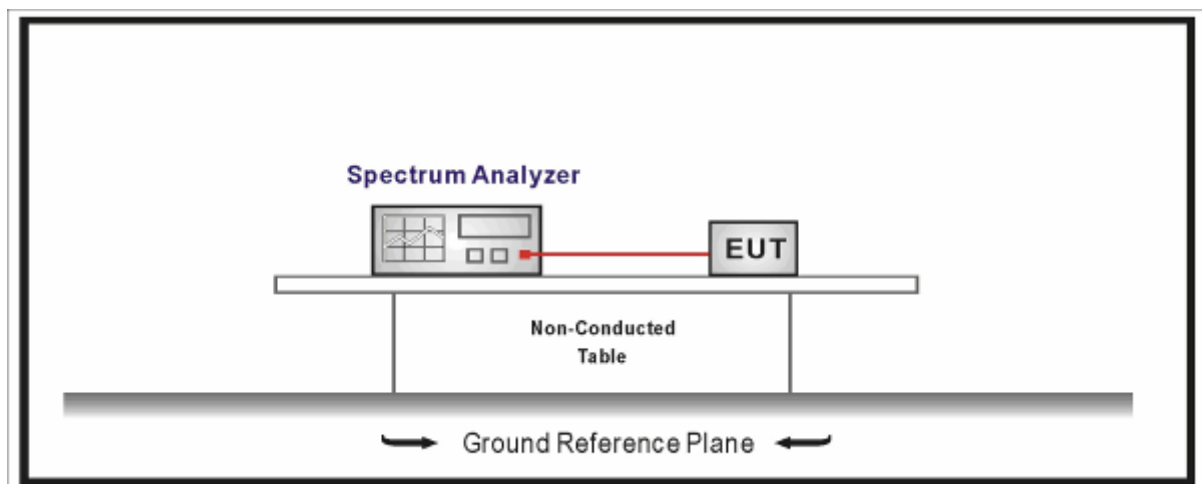
7.1. Test Equipment

Operation Frequency Range of 20dB Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2013.04.18
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2013.05.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

7.2. Test Setup



7.3. Limit

20 dB bandwidth of the emission is contained within the operation frequency band.

7.4. Test Procedure

The EUT was tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, Span greater than RBW.

7.5. Uncertainty

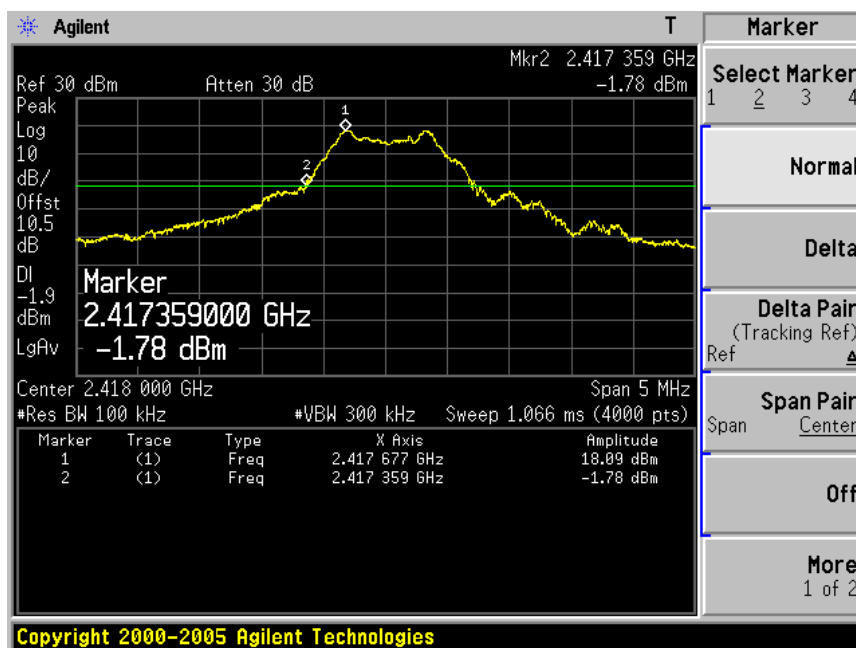
The measurement uncertainty is defined as ± 1 kHz



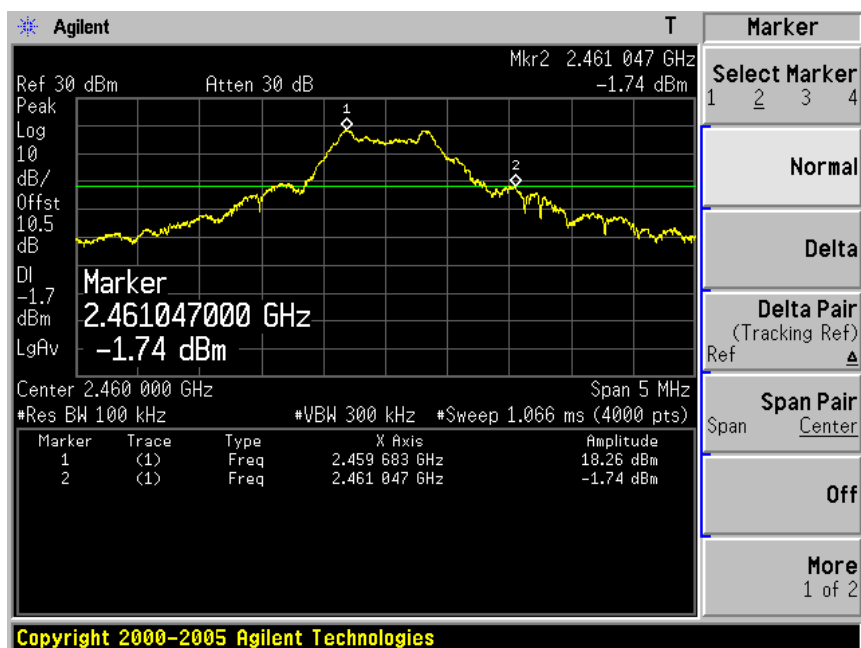
7.6. Test Result

Product	:	Surface Radio
Test Item	:	Operation Frequency Range of 20dB Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1

Channel 01 (2418MHz)



Channel 43 (2460MHz)



8. Occupied Bandwidth

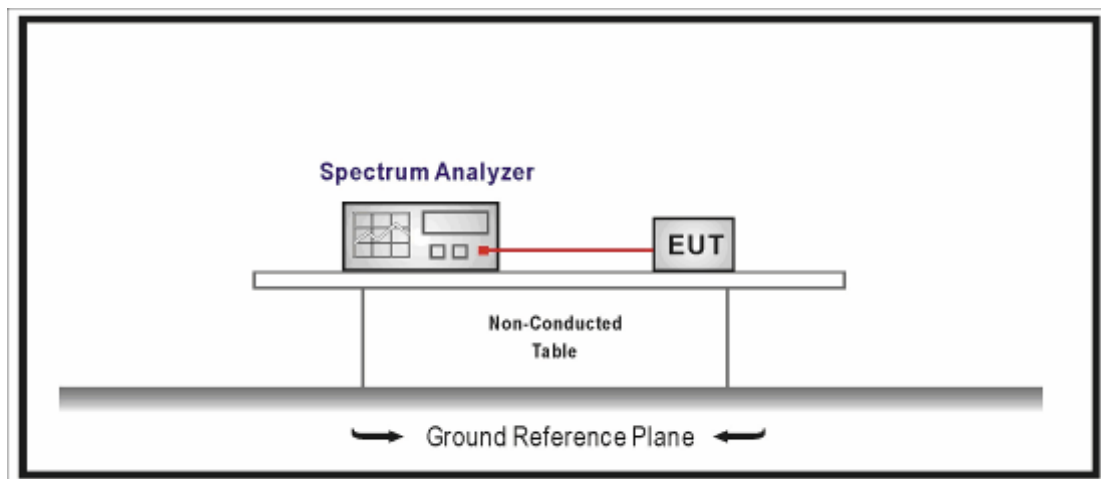
8.1. Test Equipment

Occupied Bandwidth / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2013.04.18
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2013.05.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

8.2. Test Setup



8.3. Limit

The minimum 6 dB bandwidth shall be at least 500 kHz.

8.4. Test Procedure

The EUT was tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW = 100 kHz, VBW = 300 kHz, Detector = Peak, Span greater than RBW.

8.5. Uncertainty

The measurement uncertainty is defined as ± 1 kHz

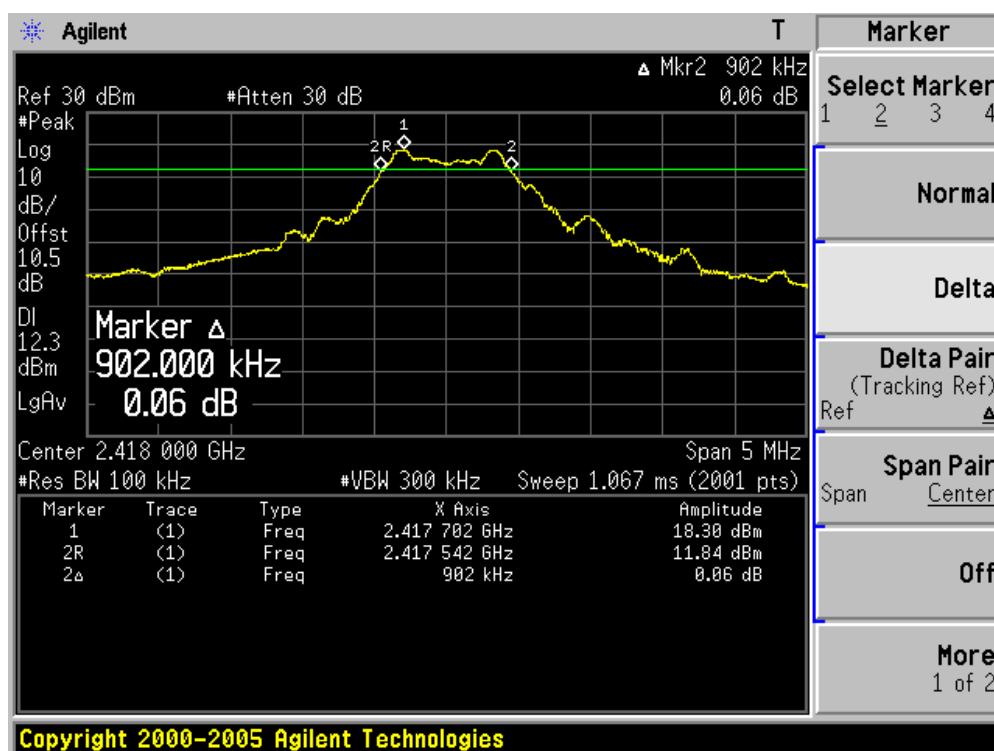


8.6. Test Result

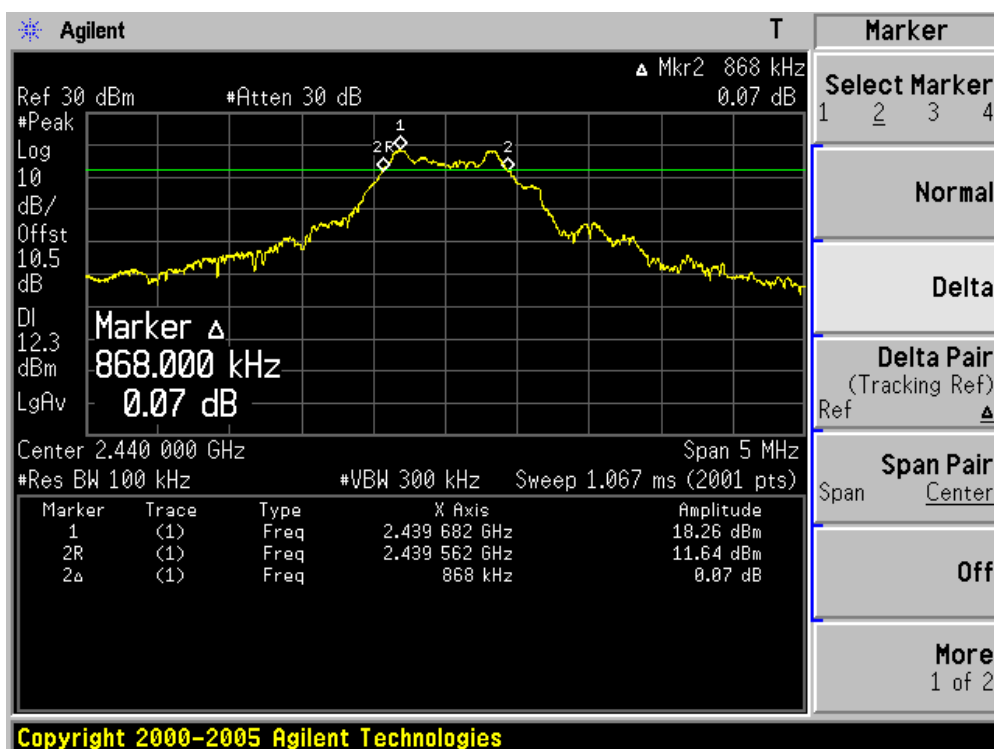
Product	:	Suface Radio
Test Item	:	6dB Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1

Channel No.	Frequency (MHz)	Occupied Bandwidth (kHz)	Limit (kHz)	Result
01	2418	902	500	Pass
23	2440	868	500	Pass
43	2460	895	500	Pass

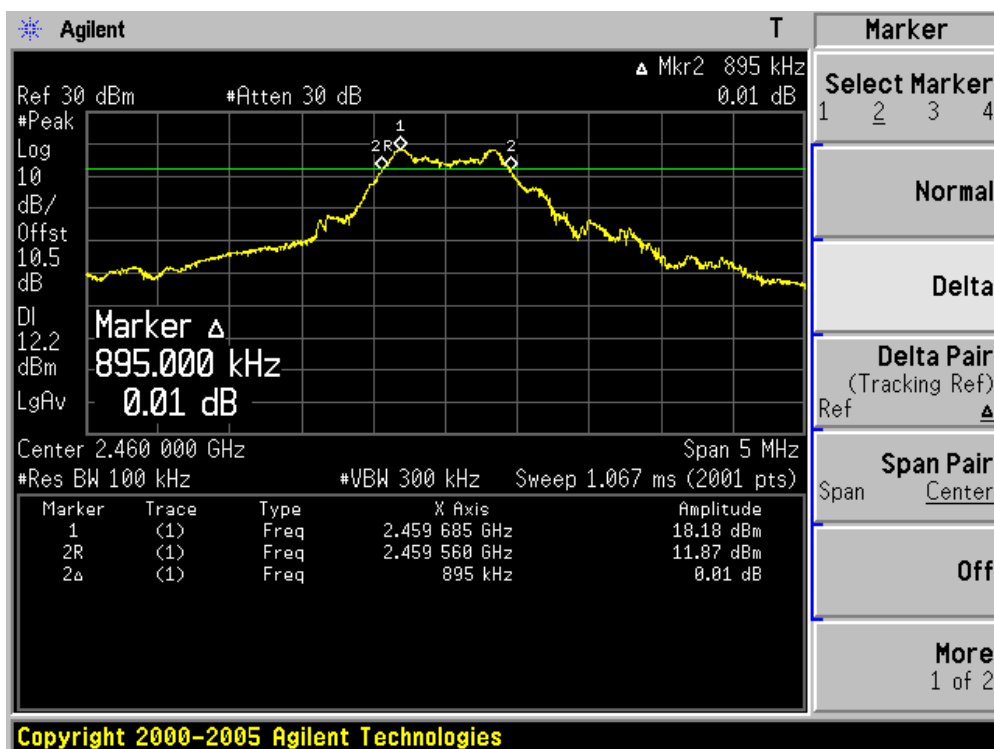
Channel 01 (2418MHz)



Channel 23 (2440MHz)



Channel 43 (2460MHz)

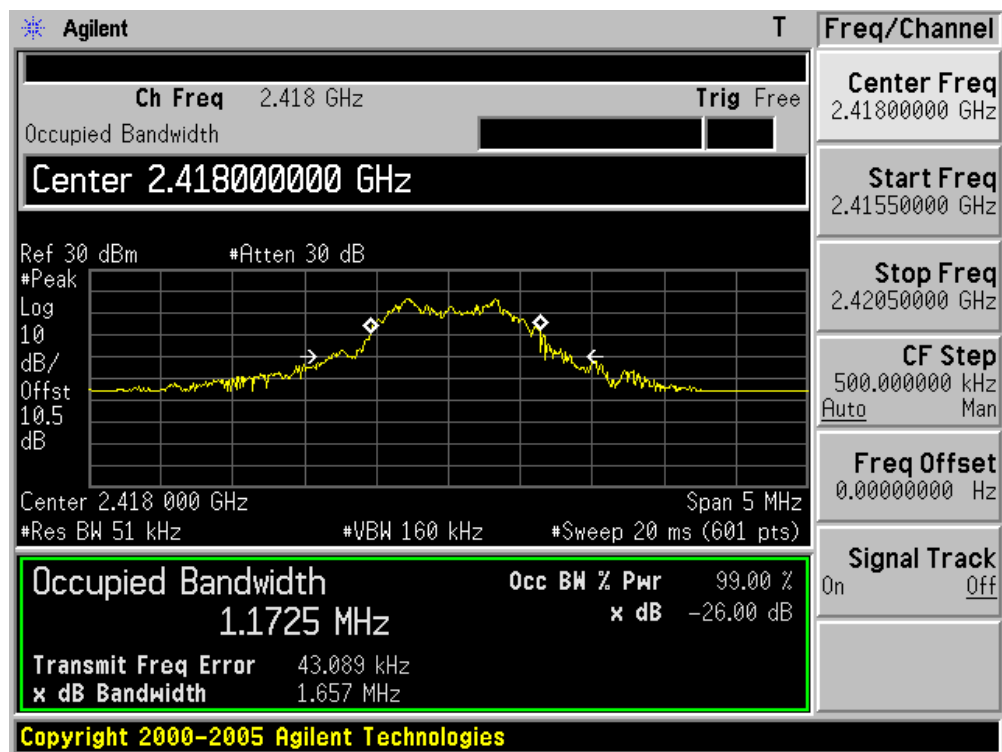




Product	:	Surface Radio
Test Item	:	99% Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1

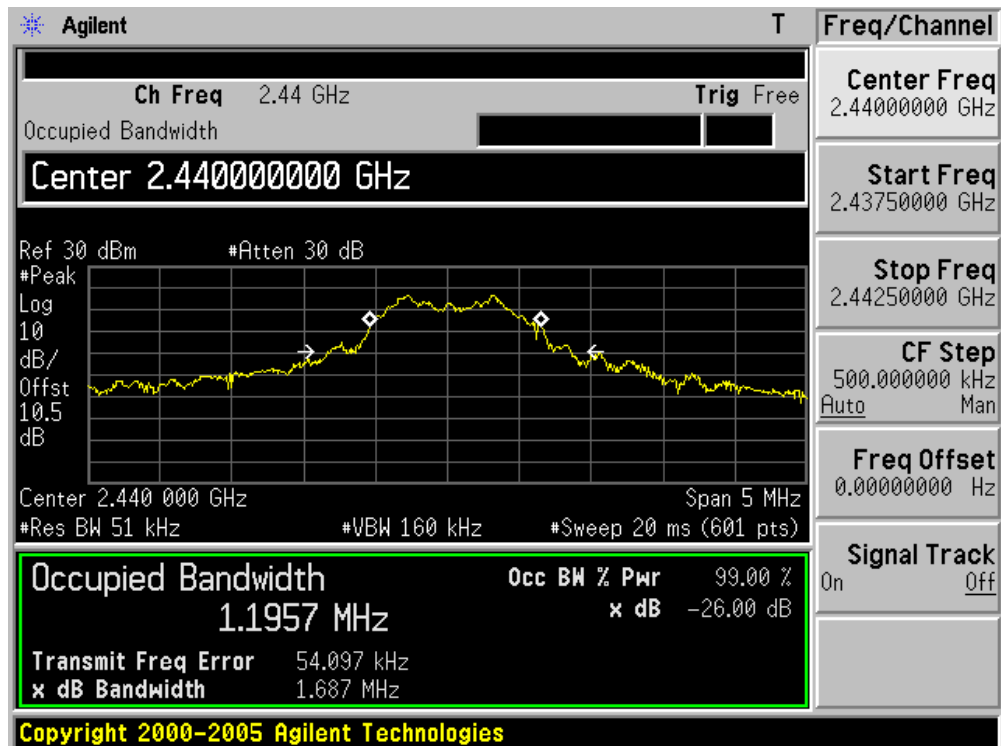
Channel No.	Frequency (MHz)	99% Bandwidth (kHz)
01	2418	1172.5
23	2440	1195.7
43	2460	1219.7

Channel 01 (2418MHz)





Channel 23 (2440MHz)



Channel 43 (2460MHz)



9. Power Output

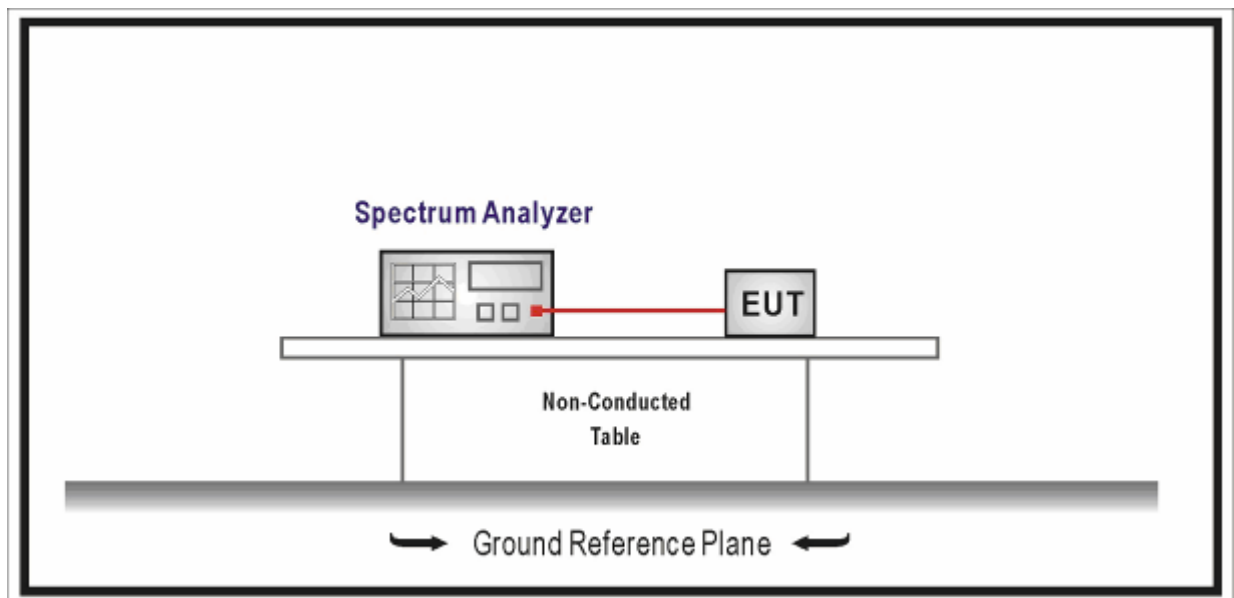
9.1. Test Equipment

Power Output / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2013.04.18
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2013.05.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

9.2. Test Setup



9.3. Limit

The maximum peak power shall be less 1 Watt (30dBm).

Note: the conducted output power limit specified above is based on the use the antennas with directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.



9.4. Test Procedure

The EUT was tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set RBW \geq DTS bandwidth, VBW \geq 3*RBW, Detector = Peak, Span greater than RBW.

9.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

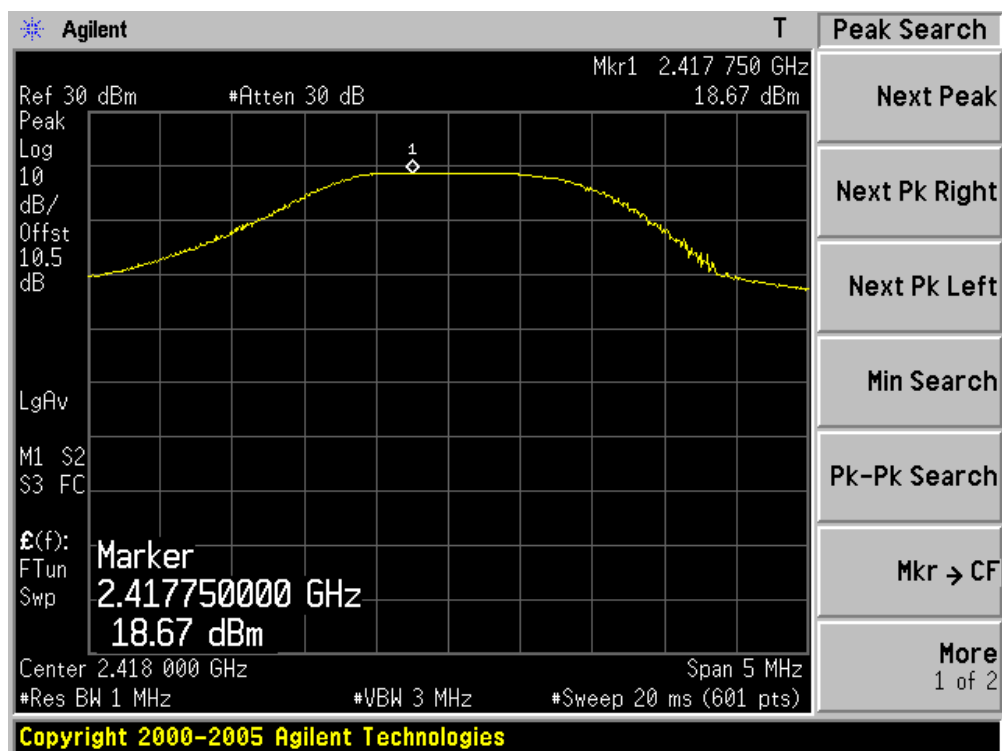


9.6. Test Result

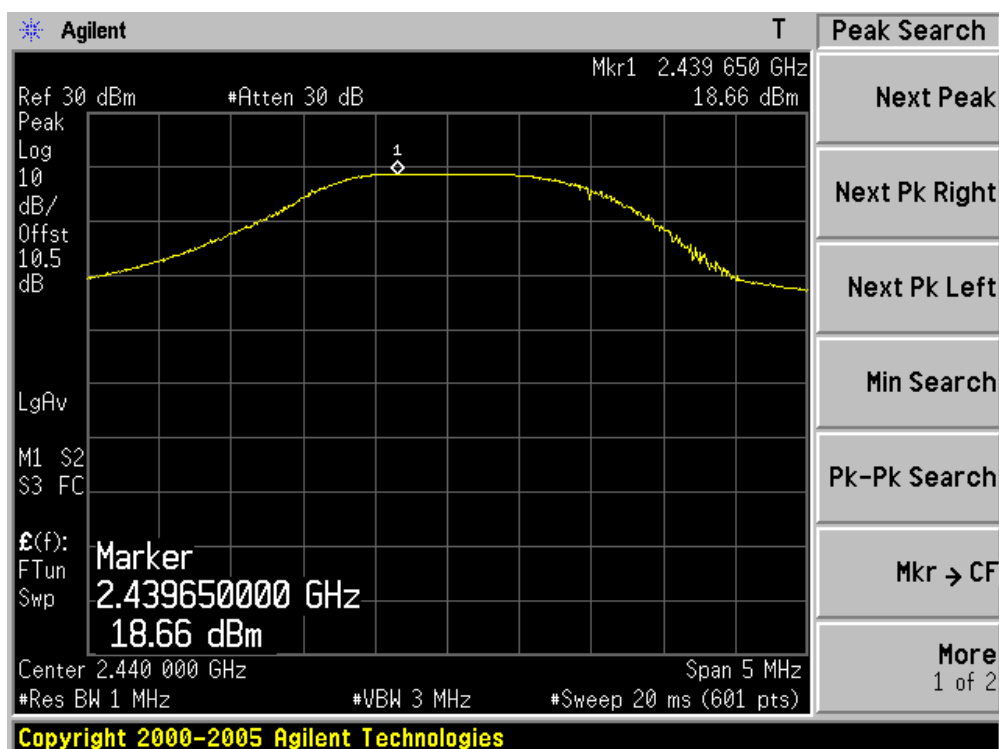
Product	:	Surface Radio
Test Item	:	Power Output
Test Site	:	TR-8
Test Mode	:	Mode 1

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
01	2418	18.67	30	Pass
23	2440	18.66	30	Pass
43	2460	18.61	30	Pass

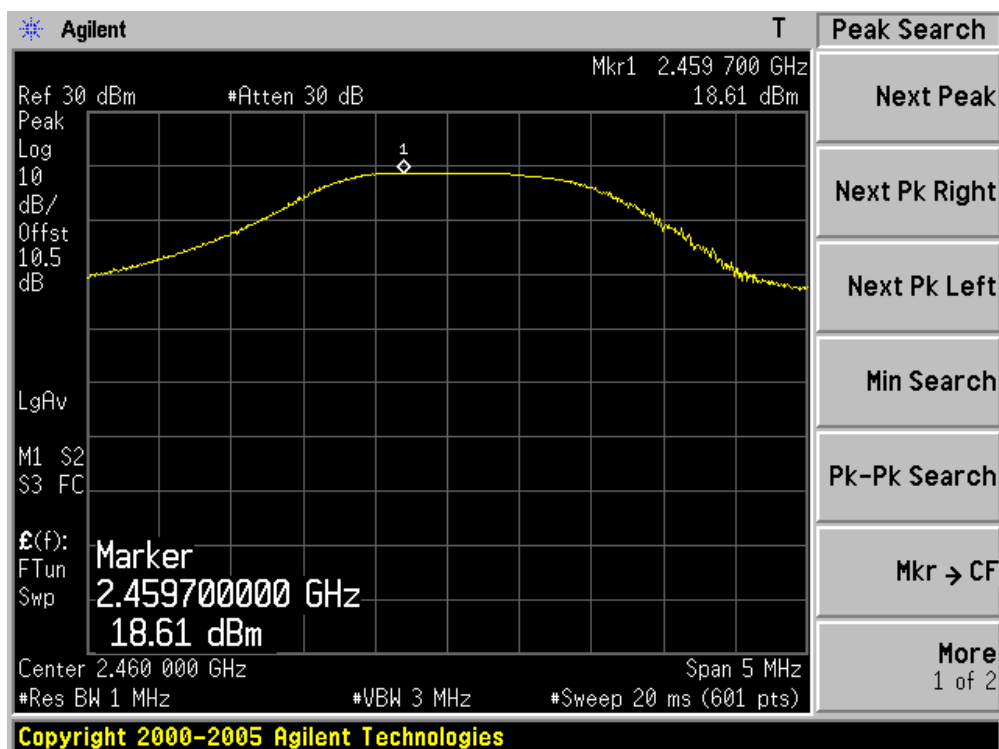
Channel 01 (2418MHz)



Channel 23 (2440MHz)



Channel 43 (2460MHz)



10. Power Spectral Density

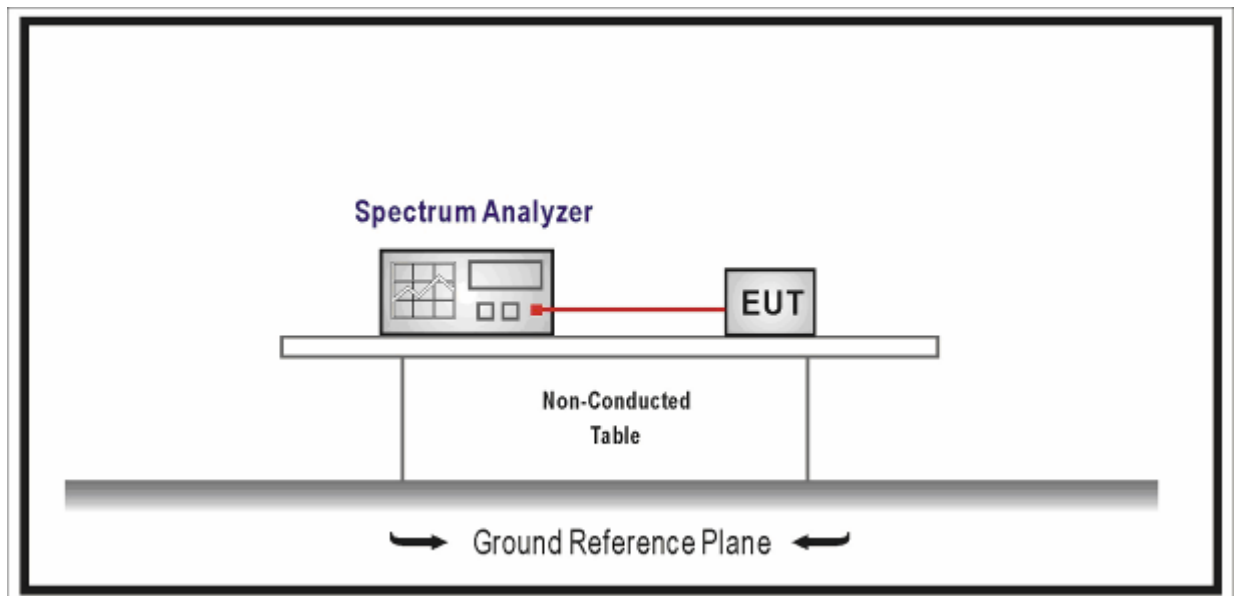
10.1. Test Equipment

Power Spectral Density / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	E4446A	MY45300103	2013.04.18
Temperature/Humidity Meter	zhicheng	ZC1-2	TR8-TH	2013.05.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

10.2. Test Setup



10.3. Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiated to the antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.



10.4. Test Procedure

The EUT was tested according to ANSI C63.10: 2009 and KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

Set the span to 1.5 times the DTS channel bandwidth, $RBW \geq 3\text{KHz}$, $VBW \geq 3*RBW$, Detector = peak, use the peak marker function to determine the maximum amplitude level.

10.5. Uncertainty

The measurement uncertainty is defined as $\pm 1.27 \text{ dB}$

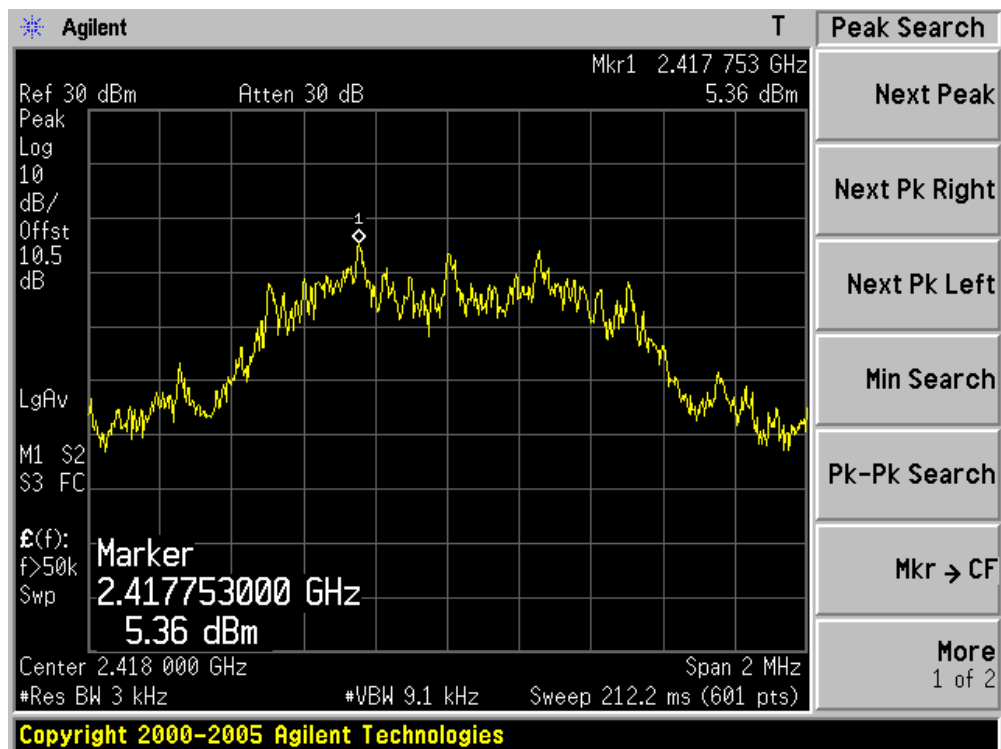


10.6. Test Result

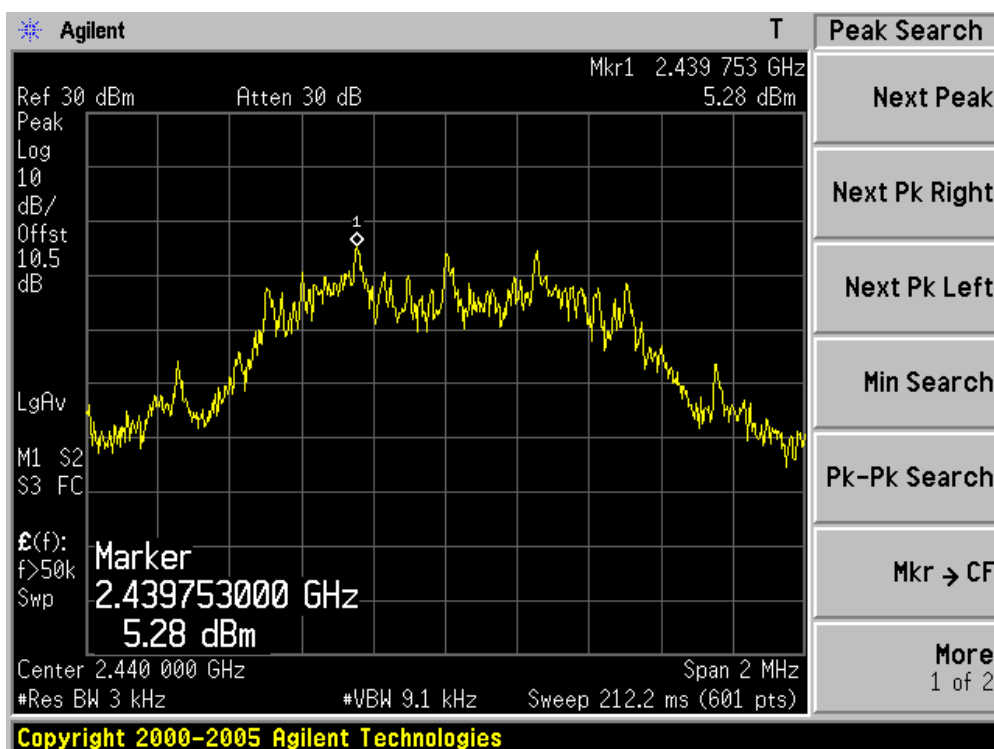
Product	:	Surface Radio
Test Item	:	Power Spectral Density
Test Site	:	TR-8
Test Mode	:	Mode 1

Channel No.	Frequency (MHz)	PSD (dBm)	Limit (dBm)	Result
01	2418	5.36	8	Pass
23	2440	5.28	8	Pass
43	2460	5.62	8	Pass

Channel 01 (2418MHz)



Channel 23 (2440MHz)



Channel 43 (2460MHz)





11. Receiver Spurious Emission for Industry Canada RSS-Gen Requirement

11.1. Test Equipment

Radiated Emission / AC-2

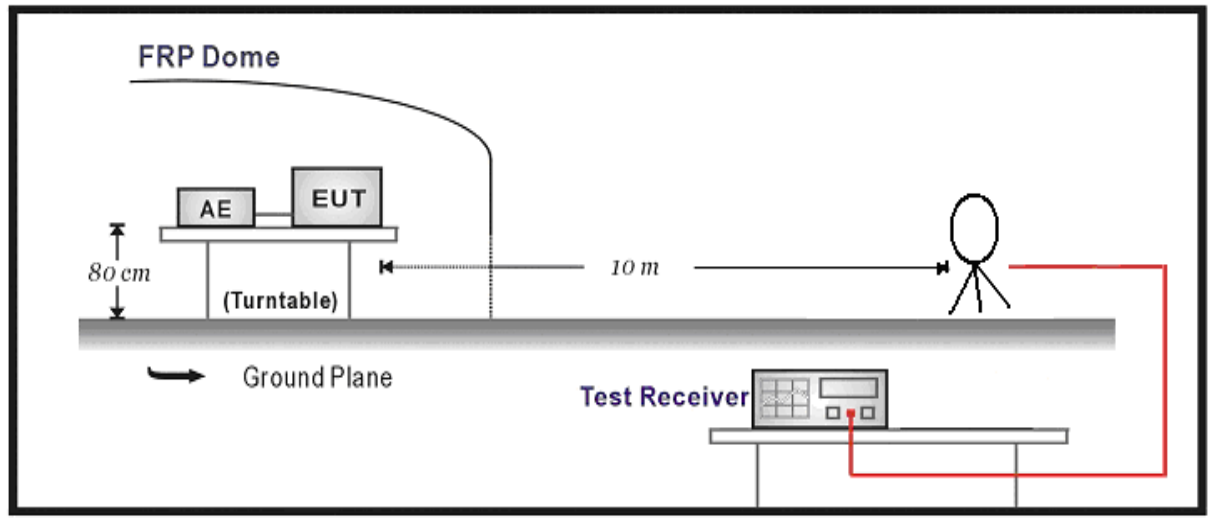
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
EMI Test Receiver	R&S	ESCI	100573	2013.04.18
Loop Antenna	R&S	HFH2-Z2	833799/003	2013.11.17
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2013.10.15
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2013.03.02
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2013.01.10

Radiated Emission / AC-5

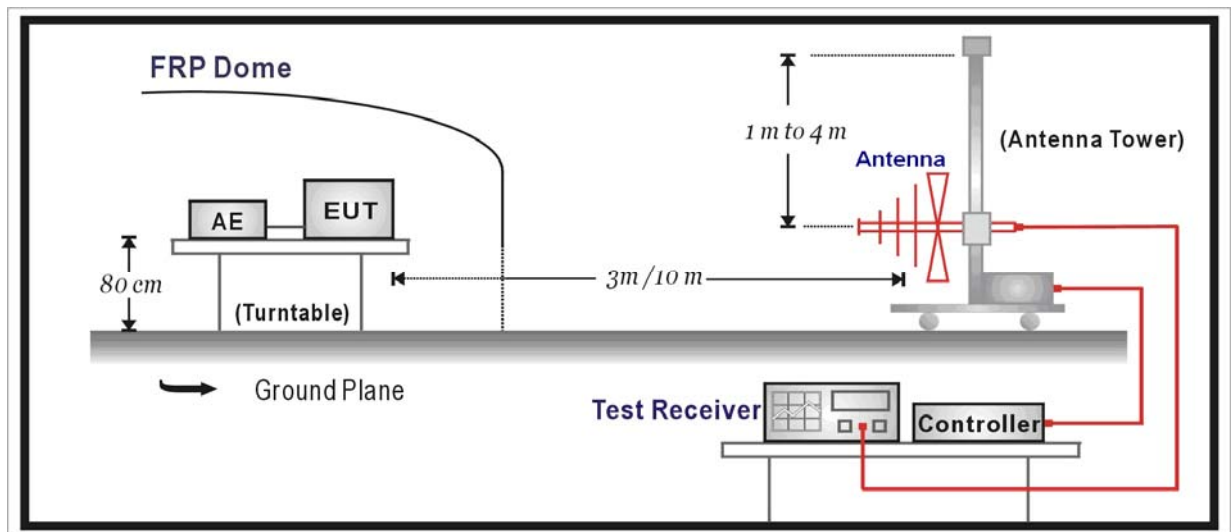
Instrument	Manufacturer	Type No.	Serial No.	Cal. Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2013.04.18
Preamplifier	Miteq	NSP1800-25	1364185	2013.05.04
Preamplifier	Quietek	AP-040G	CHM-0906001	2013.05.04
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2013.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2014.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2013.11.24
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2013.03.02
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2013.03.02
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2013.03.02
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2013.01.10

11.2. Test Setup

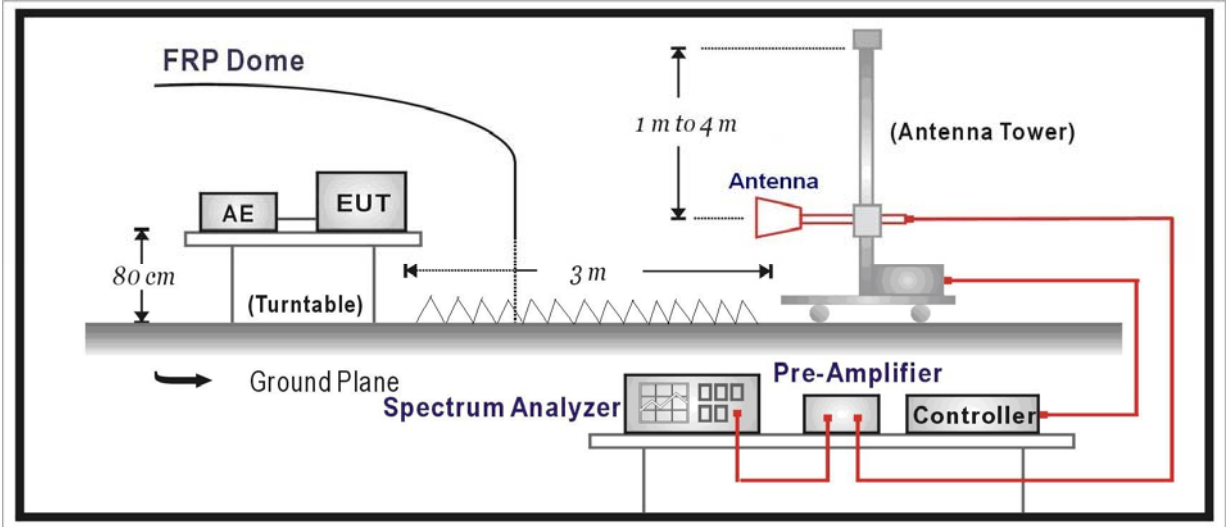
Below 30MHz Test Setup:



Below 1GHz Test Setup:



Above 1GHz Test Setup:



11.3. Limit

FCC Part 15 Subpart B Paragraph 15.109		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3: E field strength (dBuV/m) = 20 log E field strength (uV/m)

11.4. Test Procedure

According to ANSI C63.10: 2009.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2009 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 9kHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the "cone of radiation" of EUT. The 3dB beamwidth is 60~10 degrees for H-plane and 90~10 degrees for E-plane.

11.5. Uncertainty

The measurement uncertainty above 1G is defined as ± 3.9 dB

below 1G is defined as ± 3.8 dB



11.6. Test Result

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor - Preamplifier Gain

Mode1: Receive at channel 2440MHz

Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
H	288.0	19.8	20.1	39.8	46	-9.0	QP
H	312.0	24.9	20.9	45.8	46	-0.2	QP
V	288.0	21.4	20.1	41.5	46	-4.5	QP
V	419.9	11.4	24.4	35.8	46	-10.2	QP
H	1221.0	61.1	-17.2	43.9	54(Note1)	-10.1	PK
H	1748.0	61.3	-12.3	48.9	54(Note1)	-5.1	PK
V	1544.0	57.6	-16.6	41.0	54(Note1)	-13.0	PK
V	2674.5	53.3	-10.6	42.7	54(Note1)	-11.3	PK

Note1: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.